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Progress in the Instructional Film Research Program at Pennsylvania State College during 1948 is the subject of this report. Opening with a general statement, the report covers the following areas: developments and changes in organization; status and progress of projects; number, title, status, and progress of research projects; liaison; general fiscal statement; and problems confronting the program. Preliminary reports on four separate research projects are furnished: Group Learning and Testing Equipment (the "Classroom Communicator"), Relative Effectiveness of Color and Black-and-White in Instructional Films, Especially Designed Motion Pictures (Assembly of the 40 mm. Breech Block), and Relative Effectiveness of Massed versus Distributed Film Presentations. A personnel roster is included. (GO)

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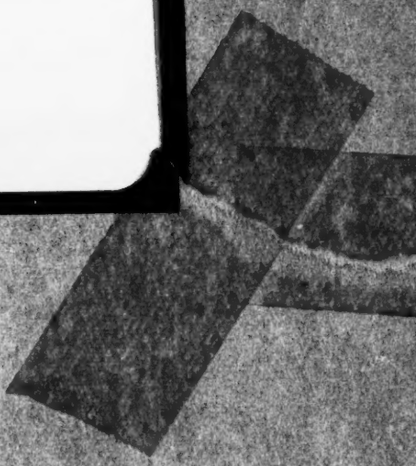
INSTRUCTIONAL FILM RESEARCH PROGRAM

Period 1 November to 31 December, 1948



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PROGRESS REPORT NO. 9

INSTRUCTIONAL FILM RESEARCH PROGRAM

Period 1 November to 31 December, 1948

The Pennsylvania State College
School of Education

SDC Human Engineering Project 20-E-4
Contract N6onr-269 T.O. VII

EM007208

I. General Statement

The Instructional Film Research Program emphasized during the report period of November and December, 1948, the following phases of the Program: 1. Testing of experimental versions of films with required test populations. 2. Analyses, summaries and interpretations of data collected on several projects. 3. Project planning and experimental designs. 4. Construction of equipment and devices. 5. Advanced program planning and promotion. Generally, research activities of all kinds have been increasing steadily toward an anticipated peak which will be reached during the late spring months.

It has been decided that soon after 1 January 1949 additional project proposals will not be formulated or activated until it is known whether or not the Research Program will be continued beyond 30 June 1949, and if continued, on what scale. Indeed, this report lists all projects which will be activated unless extremely important and feasible leads are found. It is unlikely that additional projects will be undertaken under Contract N6onr-269, Task Order VII prior to the expiration date of 30 June 1949. Therefore, the scope and pattern of this Research Program may now be considered as established. Efforts will be directed henceforth to the rapid completion of activated projects.

It is important to note a number of factors in evaluating progress reports on the Instructional Film Research Program: First, it should be realized that research in the area of sound films as instructional and training communication had to be started largely from the beginning. There is not a substantial body of well established findings, as in many other fields, to serve as a base, nor are there except in related fields many proven methods and procedures. Progress should be evaluated, therefore, relative to the very low base line from which this Research Program necessarily began. Second, it is probably very difficult for persons other than those who are attempting to do research in the area of instructional sound films, radio and television to realize the complexities and difficulties of the problems encountered. Evaluations of progress should also take these facts into consideration. Third and finally, account should be taken of the difference in overall requirements between operating a program of research and operating a research project. In research programs it is necessary to build a larger organization, with all that entails, than with a research project. It is desirable to plan attacks on the area to be investigated on a relatively broad front in order to use effectively both resources and people. These conditions and requirements necessitate more latent time for getting the program under way and more time until final reports begin to appear. Program and project research are very different in that the former includes multiples of the latter.

Previous attempts at research on instructional sound films have generally failed or ended with inconclusive and unsatisfactory results because of lack of resources, including personnel and time, commensurate with the complexities and difficulties of the problems. (See "Requirements of Research on Instructional Films," Hollywood Quarterly, Volume III, No. 3, Spring, 1948). A clear understanding of the above points is necessary if the sponsors of the Instructional Film Research Program are to avoid errors which have been made in the past by sponsorers of film research.

The convictions about the correctness of direction of effort held by those who are responsible for and know well the research pattern of Instructional Film Research Program are supported strongly by the following: 1. Conferences and discussions with experts in the fields of communications research, film production and utilization rarely reveal problems which are not being attacked or which have not been considered and slated for later attention. 2. Information from authorities in this field in Great Britain, Australia and Canada indicates that the problems under investigation are the ones which would be investigated in these countries were it possible to undertake such research. Incidentally, the uniqueness of the work of Instructional Film Research Program, with the single exception of the research being done at Yale University under the immediate direction of Mr. A. A. Lumsdaine, is confirmed on every hand. 3. Finally, from all quarters, but especially from Great Britain, come letters expressing great interest and high expectations for important results.

II. Developments and Changes in Organization

Personnel: Attachment Number One gives the current status of personnel employed on Instructional Film Research Program. Comparisons with lists of previous status report will show the changes which have been made.

Equipment: A shipment of four desks and four chairs was received through the Office of Naval Research. A pair of matched and linked Ampro Projectors was received for third dimension projection. Four government furnished Friden calculators were rebuilt, returned and put to use. Requests for equipment including a semi-portable Simplex Projector and a Mitchell 16mm camera are pending.

III. Status and Progress of Projects

The following table headed "Number, Title and Progress of Research Projects" gives in condensed form the titles of projects which have been activated to date, an estimate of percentage of total work accomplished on each project and an estimate of percentage gain during the report period of November and December.

A total of forty-five projects have been planned, evaluated and activated; one (Number 1) is inactive and one (Number 11) has been cancelled. Eleven (11) are complete to or above the 75 per cent level exclusive of preparing the final written report.

Attachments Numbers Two through Five give preliminary reports on Projects 3, 6, 9 and 10. It is suggested that careful reading of these preliminary reports as well as study of other active projects will show that the research being done is of both basic and practical importance. The problems and results are meaningful not only for sound motion picture production and utilization but also for other kinds of instruction which involve special training devices and models, conventional teaching methods, and radio and television instructional communications. Many of the problems which are being investigated are not merely analogous to the problems involved in television instruction; the problems and methods are almost identical with those involved in television communication. The Instructional Film Research Program is not only doing research on this particular medium, the sound motion picture, but in the Program sound films are being used as a means for studying training problems of general significance and of great practical importance.

The problem of transfer from a training situation to a performance situation is of central importance. Therefore, when the results of Project 10, which employed seventeen variations of films on the breech block assembly tasks, show that in terms of actual performance a level of 98 per cent was reached by two of the versions, this finding is very significant. It means that Navy trainees can be instructed almost perfectly by films alone for immediate performance on this and similar tasks. In addition to this result, the methods and procedures used in Project 10 set a model for experimental design which can be employed in much future research on films, training devices, radio and television.

Let us take another example. Instruction by any methods whatsoever involves a decision as to how to distribute instructional effort and study time. How much material should be presented during one period? There is a widespread belief which is also held in the Navy that instructional films should be about twenty (20) minutes in length. Where longer time is required to treat a subject, the films are made in a series. However, under speeded up training programs it may be desirable to mass the presentations of films. The results on Project 9 indicate that for materials and with subjects (Navy trainees) like or similar to those used in the experiment, films can be shown continuously up to a limit of one hour without significantly reducing the degree of learning. This finding when applied could save much training time, or, stated differently, the finding may be employed to speed up training.

The practical significance of the results of projects 3 and 6 is very evident. The classroom communicator which is nearing completion will have wide applicability in training situations. By means of this device measurements can be made intermittantly or continuously, rapidly and effectively without paper and pencil tests. Learning may be facilitated. Also, the device can be used to evaluate instructor training. As a result of leads from Project 6, it would seem to be unnecessary to employ expensive color films unless color per se provides crucial or critical cues for the skills or concepts to be learned. However, it may be desirable to use color to direct attention, to aid discrimination and hence to facilitate the learning of some kinds of tasks.

NUMBER, TITLE, STATUS AND PROGRESS OF RESEARCH PROJECTS

Project No.	Title	% Completed *	% Increase
1	An Exploratory Study of Educational Films	30	
2	Film Analyzer Equipment	95	
3	Group Instruction and Test System (Classroom Communicator)	98	3
4.	Critical Evaluation and Summary of Experimental Literature on Instructional Films	80	10
5	Summaries and Critical Evaluation of Selected Research Literature in Psychology and Education Pertinent to Motion Pictures	50	5
6	Relative Effectiveness of Color and Black and White in Instructional Films	90	15
7	Musical Background in Instructional Films	85	
8	Annotated Bibliography on Effectiveness of Music in Instructional Films	100	
9	Distributed versus Massed Film Presentations	85	10
10	Experimentally Varied Motion Pictures: I. Variations on Assembly of Breech Block of 40mm Gun	85 (correction)	
11	Design of General Model for Testing Instructional Films	Cancelled	
12	Relationship of Length, Fact Frequency and Difficulty, and Effectiveness of Instructional Motion Pictures	55	10
13	Effects of Persistent Questioning on Film Learning	75	10
14	Effects of Learner Representation in Instructional Films	75	20
15	Relative Effectiveness of Exclusive Film Instruction, Study Guides plus Films and Standard Lecture Methods	55	20
16	Filmic Illustrations of Selected Learning Principles Applied in Instructional Films	25	10

* Percentage completed exclusive of the final report.

17	Contributions of Varied Film Introductions and Summaries	30	10
18	Research Literature on Commentaries	100	20
19	Commentary Variations: I. Phase Relations, Level of Verbalization, and Learner-Reference in Instruction on Perceptual-Motor Tasks	60	20
20	Effectiveness of Three-Dimensional Instructional Sound Motion Pictures for Perceptual-Motor Learning	30	20
21	Characteristics of Subjects and Film Learning Gains	35	25
22	Attention Gaining Devices in Films	20	10
23	Physiological Indicators of Subjects' Involvements During Film Learning	25	15
24	Effects of Repetitive Film Presentations on the Rate and Amount of Learning	20	5
25	Learners' Involvement in Sound Films	20	10
26	Development of Procedures for Pre-Release Testing of Instructional Films	20	5
27	Development of Procedures for Measuring Profiles of Films on Factors Related to Learning	15	5
28	Comparisons of Learning from "Dramatic" and "Factual" Films	10	10
29	Relative Effectiveness on Learning of Right Versus Right-Wrong Methods of Film Presentations of Conceptual and Perceptual-Motor Tasks	10	10
30	Practice Effects in Film Learning	10	10
31	A Report on Instructional Film Research, Production and Utilization in Great Britain, Canada and Australia	50	50
32	Relative Contributions to Learning of Video and Audio Elements in Films	10	10
33	Employment of Sound Films for Restructuring Attitudes	15	15
34	Experiments on Functional Characteristics of the Classroom Communicator	10	10
35	The Effects of Authentic Sounds in Instructional Films	10	10

36	Effects on Learning of "Shock Sequences" in Sound Films	5	5
37	A Theoretical System and other Requirements for "Mass Media" (Sound Films, Radio and Television) Research	10	10
38	Procedural Requirements for Audience Controlled Film Flexibility for Multiple Level, Rapid and Complete Learning	5	5
39	Development of a Printing Device for the Classroom Communicator	15	15
40	Development of Very Flexible Individual Film Study Device and Its Evaluations	5	5
41	Development of a Flexible Multiple Channel Magnetic Film Recording and Reproducing System for Research and Instruction	5	5
42	Experimental Development of Equipment and Evaluation of Monaural and Binaural Sound Integration with Pictorial Fields in Sound Films	3	3
43	Development and Testing of Procedures for Infra-Red Photographic Recordings of Audience Reactions	3	3
44	Experimentally Varied Motion Pictures: II. Supplementary Study of Variations in Assembly of Breech Block of 40mm Gun	15	15
45	Summary Report on Instructional Film Research, Production and Utilization in the United States	20	5

IV. Liaison

Instructional Film Research Program acted as host for the Second Conference on Rapid Mass Training on 5 and 6 November. Those attending were: Dr. Robert Rock (Fordham), Dr. Harold Edgerton (Richards, Bellows and Henry Company), Mr. Leo Kuper (University of North Carolina), Dr. Dwight Chapman (Research and Development Board) and Mr. Joseph Gaberman (Navy, Special Devices Center). Dean M. R. Trabue, Dr. C. R. Carpenter, Dr. A. K. Kurtz and Dr. Kendon R. Smith represented the Penn State Instructional Film Research Program.

The Conference reviewed the First Conference which was held in September, heard brief progress reports and then concentrated on systematic and detailed reports of the Instructional Film Research Program.

A general and important understanding which derived in part from, and was emphasized by, the Conference was the realization of the close relationship and similarities of problems, methods and application procedures among the interests represented. For example, it was realized that series of experimental film versions produced and tested by Instructional Film Research Program could be used in television research. (See Conference Report previously submitted to S. D. C.)

Mr. Leslie P. Greenhill arrived from England in November for at least eight months of work with the Instructional Film Research Program.

Mr. W. D. McDonald of the National Film Board of Canada visited the Program and expressed strong interest in the research. He reported that film people in Canada realize the need for this kind of research but at present nothing along this line is being done. Captain William Exton spent two days working with the Program and lectured to the Research Staff. Mr. R. O. Bieling of the Ansco Corporation explored the possibilities of cooperation of his Company with Instructional Film Research Program. Mr. James J. Duva of Fordham spent two days at Penn State for the purpose of familiarizing himself with problems being investigated and methods being used. Mr. Duva was especially interested in learning of possibilities for transfers of methods and procedures from Instructional Film Research Program to research on television. Mr. R. C. Larsen from the University of Indiana visited the Program. He proposed that results of this Research Program be made available on a wide scale. As a means of doing this quickly, he proposed that a high level conference be held at Penn State during the late spring or summer of 1949.

Contacts have been maintained with The Signal Corps, the Adjutant General's Office and the Research and Development Board. Previously established liaison with Air Corps developments relative to film research have been maintained only indirectly through the Corps' appointed consultants - Mr. A. A. Lumsdaine and Dr. J. J. Gibson. Cooperative work with Eddie Alberts Productions, Inc. on pre-release testing was discontinued by "another government agency" presumably some division of the U. S. Public Health Services.

Detailed reports were made on audio-visual aids equipment and procedures of the Great Lakes Naval Training Center to the appropriate Section of BuPers. This was done voluntarily as a service to Great Lakes and BuPers in return for their very valuable help in setting up and helping to carry out testing programs on experimental films.

V. General Fiscal Statement

Expenditures for the first six months of 1948-49 year amounted to approximately $55,000.00. It may be expected that the rate of expenditures will increase along with the scheduled increase in productions of experimental films. The revision of Task Order VII of Contract N6onr-269 has resulted in the settlement of accounts with the College. Response to a request to the Fiscal Officer of S. D. C. for relinquishment from obligation of an additional ten thousand dollars ($10,000.00) has been delayed until accounts, fiscal plans and prospects could be reviewed and discussed with representatives from the Special Devices Center. Currently it is expected that there will be an unexpended balance on 30 June and it is requested that every consideration be given to the possibilities of having this balance applied to finance in part the extension of the Instructional Film Research Program for the period 30 June 1949 to 30 June 1950.

VI. Problems

The crucial problem of this Research Program is that of time and manpower. Attempts to find and employ qualified persons on a full-time basis for the second semester of 1948-49 have not been successful. However, the need for personnel will be met to some degree beginning 1 February by transferring three Graduate Fellows (Navy) to the status of full-time Research Assistants.

Recently the Navy, perhaps either BuShips or BuOrd, purchased fifty (50) Mitchell 16mm cameras for purposes of "research and training." Since Penn State is the most active research center sponsored by the Navy, it would seem reasonable that one unit of this equipment should be made available to Instructional Film Research Program. Accordingly, a request for a camera of this type was made through the ONR Local Representative. It is possible that S. D. C. may assist in arranging for this loan of equipment.

There seems still to be the need for explaining and interpreting the work of the Instructional Film Research Program to those directly responsible for sponsoring this research, to responsible authorities of the Office of Naval Research and to other ranking officers of the Department of Defense who are interested in and responsible for training. Likewise there appears to be a continuing need for coordinating the interests and efforts of the Navy, the Signal Corps and Air Corps in the area of instructional film research. Those responsible for the Instructional Film Research Program stand ready to be of all possible assistance to the Special Devices Center or others along these lines.

Attachment No. 1

PERSONNEL ROSTER

INSTRUCTIONAL FILM RESEARCH PROGRAM

1 February to 30 June 1949

Advisory Committee:

Dean M. R. Trabue, School of Education (Chairman)
Dr. C. R. Carpenter, Director of Program (Secretary)
Mr. I. C. Boerlin, Central Extension - Supervisor, Audio-Visual Aids
Dr. R. Adams Dutcher, Chairman, Council on Research
Dean Ben Euwema, School of Liberal Arts
Dean George L. Haller, School of Chemistry and Physics
Dr. George F. Johnson, Associate Professor of Agricultural Extension
Dr. S. L. Land, Head, Department of Industrial Education
Dr. Bruce V. Moore, Head, Department of Psychology
Mr. Hugh C. Pyle, Central Extension - Supervisor, Informal Instruction
Dr. Kendon R. Smith, Research Coordinator of Program
Dr. Eric A. Walker, Head, Electrical Engineering Department and
Director, Ordnance Research Laboratory (Navy)

Consultants:

Dr. Stephen Corey, Teachers College, Columbia University
Dr. Edgar Dale, Ohio State University
Dr. Charles Hoban, Jr., West Chester State Teachers College
Mr. Harold Kopel, Encyclopedia Britannica Films
Mr. Arthur A. Lumsdaine, Director, Yale Film Research Project
Dr. Mark A. May, Director, Institute of Human Relations (Yale)

Research Staff:

Dr. Clarence R. Carpenter, Professor of Psychology (Program Director)
Dr. Kendon R. Smith, Associate Professor of Psychology (Research Coordinator)
Mr. F. T. John (Director, Engineering Research and Development Section)

Full-time Staff Members:

Mr. Philip Ash, Research Assistant
Miss Fanna E. Brown, Writer and Assistant in Drama
Mr. John B. Cannon, Project Engineer
Mr. Leslie P. Greenhill, Research Associate
Mr. Nathan Jaspen, Research Assistant
Mr. Sol M. Roshal, Research Assistant
Mr. John V. Zuckerman, Research Assistant

Part-time Staff Members:

Mr. Edward Abramson, Assistant Professor of Sociology ($\frac{1}{2}$ time)
Dr. C. R. Carpenter, Professor of Psychology ($\frac{1}{2}$ time)
Dr. Kinsley R. Smith, Professor of Psychology ($\frac{1}{4}$ time)

Flexible:

Dr. James Gemmell, Associate Professor of Economics and Business Education
Dr. Joseph N. Grosslight, Assistant Professor of Psychology
Dr. Albert K. Kurtz, Professor of Psychology
Mr. Chester Lynn McTavish, Doctoral Candidate
Dr. Harold E. Nelson, Assistant Professor of Speech
Dr. Abram W. VanderMeer, Associate Professor of Education
Dr. Edward B. van Ormer, Associate Professor of Psychology
Dr. William S. Vincent, Professor of Education

Motion Picture and Recording Studio:

Mr. Frank S. Neusbaum, Administrative Head
Mr. Delmer P. Duvall, Assistant Specialist, Motion Picture Production
Mr. Henry Miller, Associate Specialist, Motion Picture Production
Mr. Paul H. Seitzinger, Assistant Specialist, Motion Picture Production
Marjorie A. Bloomfield, Secretary

Graduate Research Fellows (Navy):

Mr. D. Morgan Neu, Psychology
Mr. Dean S. Northrop, Education
Mr. Loran C. Twyford, Psychology
Mr. John P. Kishler, Education

Graduate Assistants:

Mr. Chester Lathrop, Agriculture Education
Mr. Charles A. Norford, Agriculture Education
Mr. Robert C. Nuckols, Psychology
Mr. John Tyo, Drama and Motion Picture

Stipend Scholars:

Mr. Henry R. Brenner, Psychology
Mrs. Jeanette S. Walter, Psychology

Student Assistants:

Mr. Robert Benson
Mr. BenAmi Blau
Mr. Theodore Blau
Mr. James Gallagher
Miss Margaret Myerly
Mrs. John Zuckerman (Technical)

Engineering Research and Development:

Mr. F. T. John, Engineer (Director)
Mr. John B. Cannon, Jr., Project Engineer
Mr. Ray A. Bland, Draftsman
Mr. Charles Brouse, Construction Technician
Mr. Melhart D. Chelosky, Construction Technician
Mr. William E. Shaw, Construction Technician
Mr. Milton C. Stone, Construction Technician
Mr. Harris Zeitzew, Construction Technician

Clerical Staff:

Betty Forry, Project Secretary
Jean Wilson, Secretary-Librarian, Information Center
Shirley Blau, Test Scoring Machine Operator
Helen Hayes, Assistant Statistician
Gloria Kahn, Secretary-Typist
Betty Mohnkern, Secretary-Tabulator
Vera Shultz, Secretary-Accountant

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Mr. Lawrence J. McGrael, Jr., Property Clerk
Mr. Paul Meyers, Equipment Maintenance

Cooperating Divisions of the College:

School of Education
- A. Department of Psychology
- B. Department of Education
- C. Business Education

School of Liberal Arts
- A. Economics and Business Education
- B. Department of Speech
- C. Department of Sociology

School of Chemistry and Physics
- A. Physics Department

Central Extension
- A. Audio-Visual Aids Library
- B. Motion Picture and Recording Studio

School of Agriculture
- A. Agriculture Education
- B. Agriculture Extension

Central Library

Attachment No. 4

PRELIMINARY REPORT ON PROJECT NO. 9

RELATIVE EFFECTIVENESS OF MASSED VERSUS DISTRIBUTED FILM PRESENTATIONS

Philip Ash

I. Statement of the Problem

a. What is the relative learning effect of presenting a standard one-hour film unit of instruction in each of the following ways?

(1) in one one-hour period;
(2) in two or more equally spaced periods, during each of which a part of the unit, lasting 15 minutes (if four periods are employed) or 30 minutes (if two periods are employed).

b. What is the relationship between the amount of learning and subjects' attitudes toward the film-period's length? (as measured by a rating scale)

c. What is the effect of possession of previous knowledge on massed as opposed to distributed presentation?

d. To what extent do relative differences, if any, persist as the retention period is increased?

II. Procedure and Results

Four film series were used, two each with a given population as follows:

A. Navy

Rules of the Nautical Road Series, Films MN 202, I, F, G
Hydraulics Series, Films MN1730 D, E, G

One company served as a control for each film series, taking the test but not seeing the films. Two companies saw each film in a single one hour period (massed). Two companies saw each series in four 15-minute periods (spaced). The total number of subjects was 940.

Tentative Conclusions from Navy Populations

The data available at this time seem to warrant the following generalizations:

(1) The groups were substantially homogeneous with respect to two matching variables used - GCT scores and MA scores. An analysis of variance test shows that the Null hypothesis with respect to these variables is satisfied.

(2) The experimental group means were significantly greater than the control group means for both films. Therefore, some learning took place.

(3) The means among the experimental groups did not differ significantly. Therefore, no advantage has been demonstrated for spaced presentation as opposed to massed presentation.

(4) Analysis of the ratings suggests that no significant difference exists with respect to attitude of trainees toward the massed or spaced presentations.

(5) A significant difference seems to be indicated between the test performance of subjects with previous knowledge and those lacking such knowledge. This indication was obtained from those subjects who had had courses in physics (for hydraulics series) or had studied the "Rules of the Road" in the Bluejackets Manual. Within each company, the "Previous Knowledge" group scored higher than the "no previous knowledge" group. However, no significant difference is noted between those with previous knowledge who were subjected to the massed presentation as compared with those subjected to the spaced presentation.

Therefore, it may be concluded, with respect to the Navy population, that, within the limits explored, learning from films will be as effective if a relatively large amount of material is presented in one period as if the material is divided into several short periods.

B. Civilian Psychology Classes

Kellogg's Ape and Child Series - four films
Masserman's Cat Neurosis Series - four films

Four classes served as controls for both series, they took the tests, but did not see the films. Each film was shown in one period to each of three classes, in two 30-minute periods to each of two classes, and to each of two classes in four 15-minute periods. Each experimental group saw both series, each one according to a different spacing pattern. In the case of the Cat Neurosis Series only, one set of classes (a 1-hour, 30-minute, 15-minute set) were given retention tests two weeks after the films had been shown. In two other classes, the tests were given one week later.

The following generalizations seem to be warranted:

(1) The classes were homogeneous with respect to the principle matching variable used: college grade-point-average to date.

(2) The experimental group means were significantly greater than the control group means. Therefore, it is certain that film learning took place.

(3) The means among the experimental groups <u>did not</u> differ significantly. Therefore, <u>no</u> advantage has been demonstrated for spaced presentation, as opposed to massed presentation.

(4) Analysis of the ratings suggests that some difference in attitude exists with respect to massing as opposed to spacing, the latter being preferred by the subjects. However, the effect of this difference on learning as indicated by test scores seems negligible.

(5) A significant difference exists <u>between</u> one-week retention and two-week retention, for the Cat Neurosis films. Therefore, some forgetting seems to have taken place. However, even at the end of two weeks no significant differences among the spacing patterns is noted.

One may therefore arrive at the same conclusions with respect to this replication as with the Navy population replication - within the limits tested, as much learning may be expected if the film material is massed into a single hour as if it is divided and shown in parts in several periods.

Attachment No. 5

PRELIMINARY REPORT ON PROJECT NO. 10

ESPECIALLY DESIGNED MOTION PICTURES: I. ASSEMBLY OF THE 40 MM BREECH BLOCK

Nathan Jaspen

I. General Statement of Problem

The purpose of this project was to evaluate the contribution of instructional films to the learning of the assembly of the breech block of the 40 mm antiaircraft gun. Specifically, evaluation was desired for the following variations of instructional films. These are:

a. Speed of development of subject
b. Showing errors to be avoided
c. Degree of verbalization
d. Nomenclature
e. Showing "how it works"
f. Repetition

An assembly task with time scores was selected because there could be no question regarding the validity of the criterion variable in terms of which the films were to be evaluated. The breech block was selected because it was likely to be unfamiliar to nearly all subjects (Navy recruits), because it seemed to be of suitable difficulty and because it was available from the Navy in sufficient quantity to permit individual performance tests. By suitable difficulty is meant that the breech block can almost never be assembled by a naive subject merely by chance or without instruction. Therefore, learning by subjects who saw the film could be attributed to the film. On the other hand the task was easy enough so that a film of approximately ten minutes duration was adequate for teaching the task to most subjects.

A secondary problem may be stated as follows: Granted that variation 1 teaches the subjects to assemble the breech block in 100 seconds on the first trial, while variation 2 teaches the subjects to assemble the breech block on the first trial in 200 seconds, does this difference persist in the third, fifth, or tenth trial? If the difference does not persist, a question might be raised regarding the necessity of producing variation 1, which was perhaps longer and more expensive than variation 2. Also, there was the question of whether the film instruction would contribute and the results show up in later trials.

II. Procedure

Production of the Experimental Films

Seventeen film variations were produced. Two of these served as control films; one control film included "slow speed of development," "showing of errors," "high level of verbalization," "nomenclature," and "how it works". The other control film had none of these (that is, it had "fast speed of development," "no errors," "low level of verbalization," "no nomenclature," and no "how it works"). Each control film was associated with a set of experimental variations. The positive control film was compared, in turn, with films which (except for minor modifications) had only four of the five variables included in the control film, so that any difference in effectiveness found to exist between this control film and each of the experimental films could be attributed to the omission of the fifth variable from the experimental variations. The negative control film was compared with films which (except for minor modifications) had only one variable present; hence a difference here could be attributed to the variable. Thus, the effect of each variable was determined in two ways: by its presence and by its absence. One general methodological purpose of this study was to determine the significance and relative effectiveness of these two procedures for studying film variables. A brief description of the seventeen films follows:

Film A — Positive control film. This film has as variables slow speed of development, errors, high level of verbalization, nomenclature and "how it works".

Film C — Differs from A in having fast speed of development. This film was shortened by one-third, hence it was necessary to have a low level of verbalization.

Film E — Differs from A only in omission of errors.

Film B — Differs from A only in having a low level of verbalization.

Film D — Differs from A only in omission of nomenclature.

Film F — Differs from A only in omission of "how it works".

Film G — Like film F, except for inclusion of extra assembly sequence in place of "how it works" variable.

Film K — Negative control film.

Film P — Like K, except for presence of slow speed of development.

Film M — Like K, except for presence of errors.

Film Q — Like K, except for high level of verbalization. This film was nearly doubled in length, therefore speed of development was necessarily slow.

Film J Like K, except for presence of nomenclature.

Film N Like K, except for presence of "how it works" variable.

Film O Like N, except for omission of one assembly sequence to balance inclusion of "how it works" variable.

Film H An "in-between" version. Like A except that it lacked errors and "how it works".

Film I An "in-between" version. Like K except for presence of errors and "how it works".

Film L Repetition film. Like A, except for repetition of every sequence.

III. The general structure of a typical film was as follows:

A. Introduction

The anti-aircraft gun was shown in action. The picture dissolved to a sequence on the breech block--"the heart of the gun". Narrator said, "This film will show you how to assemble the block. Then you will be asked to do the job yourself." This sequence was used to begin all films.

B. "How it works"

The block was shown disassembled, and the operation and "logic" of the block was shown. An animation sequence, borrowed from the Navy, was included. This sequence was omitted for those films without a "how it works" variable.

C. Assembly I

This assembly sequence was present in all films. The parts were put together, one by one. Errors were included in this sequence when this variable was a part of the film. Otherwise errors were omitted, and the assembly proceeded perfectly.

D. Assembly II

This sequence was present in all films except O. There was a second assembly sequence, which in all cases was without errors.

E. Assembly II A

This sequence was only present in G. It was like assembly II.

F. Conclusion

Parts were shown disassembled. The narrator said, "There are seven parts that fit into the breech block. Can you assemble them correctly?"

G. Repetition

Repetition was only present in L, and appeared there before the conclusion. "How it works", Assembly I, Assembly II were repeated.

Variations on the content of these sequences were with regard to the use of nomenclature, level of verbalization and speed of development.

IV. The Subjects

The subjects were 2377 apprentice Seamen at the Great Lakes Naval Training Center. Tests were made during August and September of 1948. The subjects were selected in groups of 30 from each company (of about 150 men), on the basis of GCT, MA (Mechanical Aptitude), year of birth, and education. All subjects had GCT and MA scores between 40 and 60, with a combined score between 90 and 110. Where there was a choice, those were selected with a combined score nearest 100. All candidates were discarded under 17 years of age or over 21 years of age and those with less than 6 years of education. To provide for possible absentees, four substitutes were designated for each detail in addition to the 30 men selected. These substitutes met the same qualifications as the other subjects. If unauthorized subjects appeared, they were tested but their scores were discarded. Likewise, subjects who were subsequently found not to meet the specifications set forth were discarded when their disqualifications were discovered. Discarded cases were not included in the total of 2377 subjects.

V. The Proctors

There was a proctor for each subject, and six additional proctors to provide supervision, messenger service and clerical service. Proctors were selected on the basis of GCT scores, in general they had GCT scores of above 60. Those serving as clerks were selected on the basis of arithmetic test scores from among the proctors who had the highest numerical aptitude. No subjects were selected from the companies which provided proctors.

VI. The Testing Procedure

Following the showing of the films, each subject was given a disassembled breech block, with instructions to assemble it. The proctor timed him with a stop watch. The time limit for each trial was ten minutes. If a subject failed on the first trial, he was given a second trial and occasionally a third trial.

VII. Results

A. Statistical Considerations

Final results are available at present for the first trial and the results obtained are presented in Table I.

No single statistic is found to be acceptable without reservation as a measure of the effectiveness of a film. At least two general classes of statistics are available: the various measures of central tendency and the percent passing.

The percent passing is the most important criterion. If a film succeeds in teaching subjects to assemble the breech block, without assistance from instructors, manuals, or other guides, then subjects can proceed to perfect their skills. Perhaps, therefore, this is the ultimate criterion of film effectiveness. On the other hand, the number who failed for most films (by no means all films) is too small to afford an adequate measure of the effectiveness of the films. When the number who fail is 2 or 5 or 10 out of a group of 30 subjects, the standard error of the proportion passing is believed to be a misleading measure of the stability of the statistic.

Of measures of central tendency, the mean is usually regarded as most acceptable. In the present study, an arithmetic mean of the time scores could not be computed, because the subjects who failed could not be assigned time scores.

The mean of the reciprocals of the time scores could be computed, since those who failed could be assigned scores of zero. The means are performance scores, rather than time scores, and are unsatisfactory in that they are not expressed in seconds, which provided the original unit of measurement.

The reciprocal of the mean of the reciprocals is the harmonic mean, which is measured in seconds. However, this statistic would be systematically smaller than the arithmetic mean, were the latter available; and time differences between failures tend to be minimized. Thus,

film O has a harmonic mean of 570 seconds, although in fact 54.2% of the subjects who saw this film could not assemble the breech block in 600 seconds. The true median of this film is 749 seconds which is probably less than the probable arithmetic mean.

The medians are perhaps the most "valid" of the measures of central tendency presented in Table I, but also the most unstable - since they were determined by a single score, which in a range of 600 seconds or more might be off by between 10 and 30 seconds.

One question that might arise is whether the differences in the effectiveness of the films are due to the variables being measured or to the length of the films. To some extent equation for length of film is not possible, since repetition, speed of development of subject, degree of verbalization, showing of errors, and showing the "how it works" variable affect the length of the film. On the other hand, the correlations between length of film (in minutes) and median times on the first performance trial definitely indicate the potency of factors other than mere time. For the seven films where the subtractive procedure was used (Films A, B, C, D, E, F, and G), the correlation between length of film and median time is -.27; that is the longer the film, the shorter the time required for assembly, but only very slightly so. Where the additive procedure was used, (Films J, K, M, N, O, P, and Q), the corresponding correlation was -.34, despite the fact that the range in length of these films was from 6 minutes to 11 minutes. For all seventeen films, the corresponding correlation was -.54. It should be noted that the range was relatively large (6 minutes to 27 minutes) and that the differences between films involved not only to one variable but as many as six variables. It may be concluded, therefore, that length of film is a significant factor, but only insofar as it is associated with an effective variable such as slow speed of development or repetition, and not regardless of what is added.

B. Speed of Development of Subject

Film P, which differed from the negative control film K in having a slow speed of development was found to be substantially superior to K on every possible basis. Film C, which has high speed of development, was inferior to the positive control film K in every regard except p (the percent passing), and here the difference was negligible. However, film C also differed from film A with regard to to degree of verbalization, and this somewhat obscured the result.

C. Errors

Film M was substantially superior to film K in every respect. Film E was worse than film A in every respect, though not markedly so. Both results point to the efficacy of showing possible errors in instructional films.

D. Level of Verbalization

Film Q was definitely superior to film K, thus indicating the desirability of a high level of verbalization. However, film Q also had a slow speed of development. Film B, which had a low level of verbalization, was moderately superior to film A (except with regard to p, and here the difference was negligible). The results were, therefore, ambiguous. The effectiveness of a high level of verbalization was not established.

E. Nomenclature

Film J, which had nomenclature, was very slightly superior to film K. Film D, which lacked nomenclature, was more positively superior to film A. These results, while not conclusive, favor the absence of nomenclature in instructional films.

F. "How It Works"

Film N, which had the "how it works" variable was definitely superior to film K. However, film F, which lacked this variable, was at least as definitely superior to film A. It would appear that this sequence adds nothing in the case of a longer film which has other attributes, but does make a contribution to a short film.

G. Repetition

Film L, the repetition film, was in every respect the best film of the group of seventeen variations. Although it appeared to "drag" there was no doubt regarding its efficiency for teaching the task.

VIII. Conclusions

1. Instructional films can be produced and used for effectively teaching fairly complex assembly skills independently of any other instruction.

2. Repetition, slow speed of development and showing of errors are desirable attributes of effective instructional films.

TABLE I

BREECH BLOCK STUDY

Trial I

Summary Sheet

1 Film	2 N	3 M	4 σ	5 σ_M	6 M_H	7 Med.	8 Q	9 $\sigma_{Med.}$	10 Q_3	11 Q_1	12 $\sigma_{Q_{1.3}}$	13 p	14 σ_p	15 D	16 E	17 V	18 N	19 H	20 Min.
A	233	7.442	5.013	.329	134	150	76	9.250	247	95	10.057	.880	.021	*	*	*	*	*	19
C	116	6.388	4.584	.427	157	174	100	17.251	311	111	18.755	.888	.029	-	*	-	*	*	12
E	141	7.028	4.884	.413	142	157	97	15.176	291	97	16.499	.879	.027	*	-	*	*	*	16
B	118	7.568	4.947	.457	132	134	109	18.642	307	89	20.268	.873	.030	*	*	-	*	*	19
D	147	8.136	5.711	.473	123	127	80	12.256	246	87	13.325	.884	.026	*	*	*	-	*	19
F	118	9.280	4.296	.397	108	106	46	7.871	173	82	8.557	.983	.012	*	*	*	*	-	15
G	119	9.874	4.960	.457	101	103	35	5.959	147	77	6.479	.958	.018	*	*	*	*	-S	16
H	116	7.319	4.992	.466	137	162	79	13.630	255	97	14.819	.897	.028	*	*	*	*	-	12
I	116	7.431	4.635	.432	135	138	90	15.524	273	93	16.878	.922	.025	-	*	-	-	*	12
K	266	4.447	5.376	.330	225	346	228*	25.973*	600*	144	28.239*	.624	.030	-	-	-	-	-	6
P	116	7.207	4.636	.432	139	156	61	10.520	228	106	11.437	.914	.026	*	-	-	-	-	11
M	117	6.402	4.265	.396	156	164	106	18.203	324	112	19.790	.915	.026	-	*	-	-	-	7
Q	120	7.100	4.536	.416	141	152	73	12.378	245	99	13.457	.900	.027	*	-	*	-	-	11
J	150	4.547	5.104	.418	220	332	229	34.742	600*	142	37.772	.647	.039	-	-	-	*	-	6
N	150	5.407	5.341	.438	185	289	248*	37.624*	600*	103	40.905*	.747	.036	-	-	-	-	*	10
O	118	1.754	2.292	.212	570	600*	138*	23.603*	600*	325	25.661*	.458	.046	-	-	-	-	*S	8
L	116	10.491	5.558	.518	95	101	30	5.172	136	75	5.623	.983	.012	*	*	*	*	*R	27
	2377																		226

*The failures were assigned a score of 600 seconds.
The Q and median statistics are therefore too small for these films.

Attachment No. 2

A PRELIMINARY REPORT ON PROJECT NO. 3

GROUP LEARNING AND TESTING EQUIPMENT
(THE "CLASSROOM COMMUNICATOR")

F. T. John

I. Statement of the Problem

The instruction and training procedures now employed and those which will probably be used in the future involve increasingly large groups or classes. Training requirements which may need to be met under emergency conditions, with necessary emphasis on speed and numbers, will further increase the sizes of groups with which instructors must deal. Furthermore, the employment of sound motion pictures, radio and television with their potentialities for communicating directions, instruction and information increases the demands made on instructors if they are to be effective in dealing with large numbers of students or trainees. Under these conditions it becomes especially difficult, if not impossible, for instructors to meet many of the standards of good teaching.

The following are some of the rather specific problems which confront an instructor who must deal with large groups of students, or those who would use the "mass media" for purposes of instruction: 1. It is extremely difficult or impossible to relate appropriately the course and unit content to the difference in the abilities, interests, and achievement levels of various individuals. 2. As numbers in classes increase, instruction becomes more and more impersonal; the instructor must deal with the group as a whole or "en masse." 3. The tasks of evaluating learning or training and of assaying instructional efficacy become increasingly demanding and these demands, i.e. administering and scoring tests, may drain off time and energy which should be used in improving positive instruction. 4. Students or trainees are not adequately, quickly and specifically informed of their achievements, i.e. successes and failures. 5. For the student the mass or large group instructional situation is depersonalized and lacking in opportunities for responses, for participation, and for cooperation and competition with classmates.

It would seem to be required therefore, that technological devices and equipment be developed and made available for use by instructors and students which would make it possible and practical to apply the best instructional and learning procedures in spite of the difficulties and unusual requirements of rapid mass training programs and large classes.

II. Consideration of Good Conditions for Learning

The solutions to the problems as stated above demand that careful thought and attention to be given to basic or facilitating conditions of learning. It is assumed that the learning conditions which should be provided for are the following: 1. The instructional communications from an instructor or source such as a motion picture, radio or television should be clearly perceivable and understandable by students, and there should be means for checking intermittantly or continuously on whether or not this condition is fulfilled. 2. Students should be given opportunities to respond to or practice materials or skills which are being learned. This condition requires active and

continuous participation by students. 3. Both the instructor and students should have available means of knowing the immediate results of the teaching-learning processes. The instructor needs to know whether or not, and to what degree, he has presented effectively and made clear to students the meanings and explanations which he intended to communicate. The students needs to know to what degrees their responses or understandings are correct or incorrect. This condition is particularly important when during successive learning there is need for mastery of basic concepts before other concepts can be learned effectively. 4. If full advantage is to be taken of "social factors" in promoting learning, conditions must be arranged which will permit students to know and compare their scores and rates of improvement, or failures to improve, with each other as learning proceeds. Also, it should be possible to make both competitive and cooperative comparisons of the learning scores of integrated teams or groups. 5. In general, the instructor should be provided with means for knowing and taking cognizance of the level and rate of the learning of individuals as well as whole classes or groups. Furthermore, the instructional situation should provide for an optimum degree of reciprocal communication or "feed back" from the students to the instructor.

III. Consideration of Research Requirements

Research requires appropriate tools, instruments and equipment as well as appropriate procedures. The problems involved in instructional, and especially communications research, are very complex and in some instances they are unique. It seems probable that the development of new or improved research tools may make it possible to attack complex problems more effectively than has been done and to investigate problems which have not previously been studied. For example, lecture, motion picture, radio and television instruction presents complex series of materials to be learned over relatively long periods of time. Available techniques and procedures are probably inadequate for investigating serial learning of the degrees of complexity and duration involved in such instructional communications. There are needs for means of studying the on-going processes of progressive learning. For instance, this is required if proactive and retroactive learning is to be defined and measured.

The requirements of mass instruction and of research in mass instruction are thus stringent. The obvious need is for some device which will permit and encourage a close psychological relationship between instructor and students or between experimenter and subjects, even when large groups must be instructed. The present report describes the Group Learning and Testing System ("The Classroom Communicator"), a device designed to fill these needs.

IV. Design and Production Procedure

A set of preliminary functional requirements was written as a result of the work of numerous conferences involving individuals from the fields of Psychology, Education, and Audio-visual Aids. This work was done with reference to ideal requirements and with no reference to the engineering difficulties which might be encountered in accomplishing the specifications thus produced.

A period of engineering research into the possible solutions to the

proposed requirements ensued. This work was reported to the Instructional Film Research Program Staff, and the Classroom Communicator Committee was organized. A series of conferences was held, with psychologists working closely with engineers. The preliminary and general functional requirements were at this time considerably extended and worked out in detail. Again the principle emphasis was on the human engineering considerations.

The Engineering Research and Development section was organized. A set of basic design considerations was developed as a guide to the work of designing and building the equipment. A general overall system was conceived; the various parts of this system were broken down into functional units; each unit was then designed and developed in turn following a procedure which consisted of the following:

1. Several alternative models were produced.
2. Each model was reviewed by the Classroom Communicator Committee; psychological tests were conducted when indicated to determine whether the design satisfied the human engineering questions involved in the device; the best model was selected; and criticisms and suggestions for improvements were presented.
3. To cut costs and to permit the development of a more extensive instrument, many of the materials needed were tested and purchased at the war surplus stores in New York City and Philadelphia.
4. Engineering detail and assembly drawings were made for all non-standard parts.
5. Mass production systems were organized to produce and assemble the system.
6. This work was followed by systematic tests of the correctness of the design and the construction.

V. Basic Design Considerations

It was proposed to formulate, design, and develop the most thoroughly flexible and complete communicator system that the limitations of time, money, and the present state of knowledge in this field would permit. The following policy was, therefore, formulated in order to clarify and direct the work of the engineering group in carrying out this assignment:

1. Human engineering considerations are of the foremost importance.
2. Extreme flexibility is essential to the success of the device.
3. A high degree of precision and reliability is essential in a research tool intended to obtain quantitative data. This necessitates the following:

    a. A discrete variable system (such as is used in adding machines) rather than a measuring or continuous variable system (such as is used in electrical meters and slide rules) should form the basis for the design of this device.
    b. Auxilliary checking and indicating circuits must be employed to indicate immediately any malfunctioning which might develop in any critical part of the communicator system.
    c. Numerical indicators must be so designed as to be easily and precisely read at a glance in any degree of ambient illumination.

d. The electrical and mechanical ratings of all components must exceed the highest likely working loads by an appropriate margin of safety.

4. All equipment must be so laid out as to permit easy accessibility for inspection and maintenance.
5. The equipment controls should be so designed and located that their operation becomes "automatic" after only a short training period both in respect to the instructor and to the students.
6. The main functional units of the system should be built into separate cabinets to facilitate portability and maintenance.
7. There are two separate recording functions involved, consequently:

   a. A continuous recording system should be constructed to permit reaction time studies, recordings of attitude changes or judgments in response to complex stimuli such as a motion picture, or other investigations involving variables in which time is a factor.*
   b. A discontinuous recording system should be constructed to permit the machine to summarize and print for immediate use the statistics of the class reaction following each question.**

8. Methods of matériel procurement, design innovations, small scale mass production techniques, and construction scheduling which may contribute to the effort of keeping costs down should be employed wherever feasible.
9. Standard parts should be used when possible and drawings and fabrication instruction kept for all nonstandard parts.
10. The equipment should be attractive in appearance.

The Group Learning and Testing Equipment was constructed in accordance with these considerations. Photographs of the principal components are attached herewith, and a description of the function of the Equipment follows.

VI. The Classroom Communicator System and Its Functions

(Please see photographs Numbers 1, 2, 3 and 4)

The consecutive series of events in time as they occur in any instructional situation equipped with a classroom communicator system is as follows:
1. Instructional material is presented by a lecture, a film or other means.
2. During the presentation any student can signal previously agreed-to messages to the instructor such as "not clear," "too fast," "please repeat," etc. Or with the polygraph attachment ("Film Analyzer") reactions of selected kinds can be continuously recorded. For example, continuous reactions can be recorded

*The major portion of this work was done under Project No. 2, Film Analyzer Equipment and subsequently built into the Classroom Communicator.

**The general functional requirements for the device were drawn up under this project. The design and development work, however, will be executed under Project No. 39, Development of a Printing Device for the Classroom Communicator.

such as "clear - not clear," "interesting - uninteresting," "like - dislike," and "difficult - not difficult," etc. 3. After a unit or section of instruction has been presented, questions or problems can be put to the students, either questions or problems to provide opportunities for repetition and practice to reinforce learning, or questions and items of objective type tests designed for measuring learning or changes in attitudes, viewpoints, and opinions. The problems, questions and items can be presented by the instructor, in the film or commentary, by collaterally operated strip films or slides, by flash cards, or in a number of other ways. 4. When the question or problem has been presented to the group, then either automatically or under the flexible control of the instructor or operator a period of time is allowed ("decision time") during which the students can solve the problem or select from among various alternatives the answer judged to be correct. During this decision period students can make and change their answers by pressing one or several in succession of the five response keys which are provided in the private and individual response stations (See Photo No. 2). One response station is mounted on the desk of each student and in the prototype model there are forty (40) of these stations (See Photo No. 3). 5. The period allowed for the students to decide on and to select a solution to the problem or an answer to the question is ended by the throwing of a lock station switch. This may be done automatically by a pre-set interval timer or by the instructor. When the lock station switch is thrown, the last key selected remains depressed and the other four keys are inoperative. 6. When the lock station switch is thrown, several things occur simultaneously: immediately by means of a series of five lighted numbers, easily visible from the front to all parts of the room, students are signalled the correct solution or answer (See Photo No. 1); the full answer could be presented in the film or by means of collaterally operated strip films or flash cards. The timing of this sequence of events may be very important, since a means is provided for almost immediately informing the students of the correctness or incorrectness of their answers; thus the responses should be "reinforced" or "extinguished." 7. As soon as the lock station switch is thrown, the instructor has available in the relay systems and on a console panelboard the following information which is instantaneously available to him for inspection (See Photo No. 1): a. A bank of answer lights, arranged in the same order as the seats of the classroom and numbered (or named to correspond to the seats or members of a class) which gives the instructor light signals of how each individual answered the question, i.e. identification of those who answered the question correctly as well as identification of those who selected the various incorrect alternatives. b. The instructor has a series of discrete number dials which give him the number and per cent of those who selected both the correct and all the incorrect alternatives as well as a count of those who did not answer the question. 8. Forty (40) Veeder-Root electrical counters are wired into the relay circuits for counting total scores (See Photo No. 1). The designation of correct answers can be made in the console by means of a key card, or this designation can be made for each item by the instructor. The Veeder counters are numbered to correspond to seats or named to correspond to individual students. The counters summate or add up individual scores; therefore, at any time during or at the end of an instructional or testing period, each student may be told his accumulated score. The key card and the multiple weighting mechanism are so constructed as to provide for multiple and differential weightings of responses to items (See Photo No. 4). In addition, the multiple weighting device makes it possible to have five variations of the order of items, e.g. 0, 1, 2, 3, 4; 4, 3, 2, 1, 0; 0, 1, 3, 4, 2, etc. This arrangement should make the equipment useful for dealing with responses to

complex attitude scales. 9. A bank of switches in the circuits connecting with each of the forty (40) response stations and mounted on the console panel makes it possible to eliminate any seat or seats from the feed-in system and yet not interfere with the operation of the station or stations (See Photo No. 1). Also, by properly ordering these switches, the response stations, and hence the students, can be arranged into two groups. The data on these two groups can be keyed-in, read and presented separately. Thus, provisions are made for intra-group team work or cooperation as well as competition and rivalry between the two groups or teams.

The classroom communicator system has been designed and built to aid in a wide range of research. When permanent records are required in work involving procedures for standardizing tests or when item analysis and basic statistics are required in communications research, a printer is needed. Accordingly, the system has been designed to include a printing device. The printer which is being designed will automatically print, when activated by the instructor, all necessary data on each item for the scores of each of forty (40) students.

VII. Stage of Construction

The Classroom Communicator system is completed to the stage where tests can begin on many of its functions. The attached photographs indicate generally the stage of progress and structural characteristics. Designs are completed and construction is well advanced on the following parts and units: 1. A new device for the rapid indication of discrete numbers in series. 2. Wiring of the percentage interpolators. 3. Construction of commutators for converting information from the memory relays into pulses for the relay counters. 4. Final construction of key card press. In addition, final design work and construction remains to be done on the automatic timer and the printer.

Attachment No. 3

PRELIMINARY REPORT ON PROJECT NO. 6

RELATIVE EFFECTIVENESS OF COLOR AND BLACK AND WHITE IN INSTRUCTIONAL FILMS

A. W. VanderMeer

I. Problem and Purpose of Experiment

"Shall this film be produced in color or in black and white?" is a question that must be answered in the planning stage of every motion picture production. Some producers and directors may specify color on the basis of its aesthetic value, or merely because they like color. Yet the use of color stock increases production costs somewhat, and approximately doubles print costs.

It is the training film sponsor who pays these costs and, if he is interested in the learning that results from the film more than in its "box office appeal," he may well ask just how much the use of color will add to the training value of the film, and what film topics do require color.

In order to gather some evidence on the question and nature of the contribution of color in training films, a project was planned to compare the learning resulting from five Coronet color films with the learning resulting from black and white prints of these same five films. It was felt that color might be needed in films for any or all of three reasons: (1) because color is an important natural characteristic of the subject portrayed in the film and therefore may contribute to the learner's capability of identifying or understanding the subject, (2) because color is useful in making certain subjects or parts of subjects stand out (as parts of diagrams or maps) even though the subject itself is not the color it is shown in the film, and (3) because color has an aesthetic appeal. Accordingly, the five films were selected so as to exemplify each of the possible uses of color.

The five films selected were:

1. "Snakes," a film in which color was intrinsic.
2. "How Man Made Day," a film in which color was used mainly for aesthetic effects and for emphasis.
3. "Maps are Fun," a film in which color was used for aesthetic effects and emphasis.
4. "Properties of Sulphur," a film in which color was both intrinsic and served to add aesthetic effects and emphasis.
5. "Rivers of the Pacific Slope," a film in which color was employed mainly for aesthetic effects and somewhat for emphasis.

It was found practical to use five hundred and ninety-seven (597) ninth and tenth grade high school students for a test population. Color versions of the five films were shown to two hundred and seventy-three (273) students who had an average intelligence quotient of 101.18. The black and white versions were shown to three hundred and twenty-four (324) students who had an average intelligence quotient of 100.59.

II. Procedure:

Tests were constructed so that individual items tested specifically each of the possible uses or functions of color outlined in the previous paragraph. Separate items also tested information which the films presented in the commentary only or in the picture elements only, and information which was presented in the picture as well as in the commentary. The procedure was to use regularly scheduled science periods to present one of five films followed immediately by a test on the subject matter of that film. This was repeated for each film on each of five days.

TABLE I

Differences in mean test scores on items answered by information supplied by commentary, picture and both.

	Number of Students		Number of Questions in Tests	Percent Mean Score of Color Group is of Black and White
	B. & W.	Color		
Commentary Only	277	251	37	94.12
Both Pictorial and Commentary	324	273	28	104.11
Pictorial Only	324	272	14	119.13

TABLE II

Difference in mean test scores on items related to color used for purely aesthetic purposes for emphasis, and for presentation of inherent characteristics of objects shown.

	Number of Students		Number of Questions in Tests	Percent Mean Score of Color Group is of Black & White
	B. & W.	Color		
Aesthetic Color	324	272	65	104.90
Intrinsic Color	163	136	6	98.77
Color for Emphasis	324	272	6	105.37

IV. Conclusions:

The data in Table I seems to indicate that black and white films are more effective in facilitating the learning of information which is presented in the commentary only. On the other hand, color films seem to be more effective in facilitating the learning when the information is contained only in the picture part of the training film. The superiority of the color film in presenting information contained in the pictorial element of the film and repeated in the commentary is probably too small to be significant.

Table II seems to suggest that there is little difference between black and white and color films with regard to their effect on learning even when the objects shown have color which seems to be an important characteristic. However, the small number of test items on ths subject render it impossible to make any definite conclusions. Results from the three other films used in the study and from additional tests which have been administered are awaited with interest in terms of the light they may throw on this question.